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Civilian Radioactive Waste Management System Requirements Document

Revision 5H

PBCCB REVIEW DRAFT

December 2, 1998

Prepared by:
U.S. Department of Energy
Office of Civilian Radioactive Waste Management
Office of Program Management and Administration
Systems Engineering Division
1000 Independence Avenue, S.W.
Washington, D.C. 20585

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OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT PROGRAM BASELINE CHANGE CONTROL BOARD REVISION/CHANGE RECORD			
Document Number: DOE/RW-0406/A00000000-00811-1708-0003			
Document Title: Civilian Radioactive Waste Management System Requirements Document			
Rev/DCN Number & Date	BCP Number	Revision/Change Description	Pages Affected
Rev. 01 March 1994	BCP-00-94-001	Incorporates the Multi-Purpose Canister (MPC) concept into the CRWMS technical baseline	All
Rev. 01, DCN 01 May 1995	BCP-00-94-005	Resolves issues needed for the procurement of the MPC system. Also incorporates the collocation of the Cask Maintenance Facility at the MGDS. Additional changes were made to address CAR HQ-93-031.	Misc.
Rev. 02 December 1995	BCP-00-94-005	General revision to incorporate the Program Approach.	All
Rev. 02, DCN 01 June 1996	BCP-00-96-002	Provides notice to users on MPC Policy Change, i.e., The CRWMS will accept and accommodate a variety of cask/canister systems for commercial SNF which are currently available or are being developed. These may be individual spent fuel assemblies; or single, dual or triple purpose cask or canister systems. The existing MPC design, if deployed, will be in accordance with the MPC procurement specification. Until specific canister or cask systems are developed, certified and licensed, interface requirements affecting the designs of CRWMS structures, systems and components must be adequately documented and controlled in accordance with the OCRWM QARD (DOE/RW-0333). Some items may be identified as To Be Verified or To Be Determined.	Misc.
Rev. 03 November 1996	BCP-00-96-009	Streamlines the CRD to include only Program-level requirements. The Waste Acceptance System Requirements Document (SRD), Storage SRD and Transportation SRD are transferred to the WAST Project (the Mined Geologic Disposal System Requirements Document was previously transferred to YMSCO by BCP-01-96-0047). Custodian requirements (e.g., DOE SNF) will be transferred from the WA-SRD to the CRD in the next revision of the CRD.	All
Rev. 04 May 1998	BCP-00-98-004	Incorporates Producer/Custodian (DOE SNF, HLW, Navy SNF) requirements and the Hanford 15 ft. canister.	Misc.

Rev. 05 1998	BCP-00-99-0001	Incorporates Immobilized Plutonium Waste Form (IPWF) and mixed oxide SNF into the HLW requirements. Incorporates the signed MOA for Acceptance of DOE SNF and HLW as well as Naval SNF. Incorporates for planning purposes expanded repository capacities. Defines the Level 0 Scope Baseline. Incorporates the repository closure policy. Incorporates DOE SNF in Government-managed Nuclear Material.	Misc.
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TBV/TBD/TBP Log

Number	Section Number	Resp. Org.	Due Date	Brief Description
TBV 3	3.6.1.3.7.1.H.1	RW-40	TBD	Environmental Assessment Benchmark Glass (ASTM C 1285-94)
TBV 4	3.6.1.3.7.2.C	RW-40	TBD	DOE SNF Canister Specifications
TBV 5	3.6.1.3.7.2.E	YMSCO	TBD	Thermal output of DOE SNF canister
TBV 6	3.6.1.3.7.1.A 3.6.1.3.7.1.K	EM	TBD	Rationales for Hanford 15 foot canister requirements
TBV 7	3.6.1.3.6.A.1	YMSCO	TBD	Canister gas leak rate
TBV 8	3.6.1.3.6.A.2	YMSCO	TBD	Canister internal gas pressure
TBV 9	3.6.1.3.6.A.3	YMSCO	TBD	Maximum detectable amount of organic
TBV 10	3.6.1.3.7.2.D	YMSCO	TBD	Maximum gamma-ray dose
TBD 1	Table 3-1	RW-40	TBD	Annual quantity of DOE HLW/SNF to be received at MGR
TBD 2	Table 3-3	RW-40	TBD	Total years of CISF operation
TBD 3	Table 3-3	RW-40	TBD	Quantity of DOE and Navy SNF to be received at Phase I CISF
TBD 4	Table 3-3	RW-40	TBD	Quantity of Government-managed Nuclear Materials and year to be received at Phase II CISF
TBD 6	3.5.C	RW-40	TBD	HLW storage capacity of CISF
TBD 7	2.4.O, 3.6.1.3.7.1.M	MD/EM	TBD	Final design and configuration of IPWF canisters following NEPA decision process
TBD 9	3.2.1.B	RW-40	TBD	Annual quantity of commercial SNF to be received at the MGR from 2034 to 2041

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1. INTRODUCTION

1.1 IDENTIFICATION

This document specifies the top-level requirements for the Civilian Radioactive Waste Management System (CRWMS). The document is referred to herein as the CRD, for CRWMS Requirements Document.

1.2 PURPOSE

The CRD establishes requirements for the design, development, and operation of the CRWMS. It specifically addresses the top-level governing laws and regulations (e.g., *Nuclear Waste Policy Act* (NWPAct), 10 CFR Part 60, 10 CFR Part 71, etc.) along with specific policy, performance requirements, internal and external interface requirements, and system architecture. The CRD shall be used as a vehicle to incorporate specific changes in technical scope or performance requirements that may have significant program implications. Such may include changes to the program mission, changes to operational capability, internal or external interfaces, acceptance of additional waste forms, and high visibility stakeholder issues.

Interface requirements are covered in Section 3.6. For commercial spent nuclear fuel (SNF) technical requirements are covered by a general reference to the Standard Contract, 10 CFR Part 961. For Government-managed nuclear materials, acceptance criteria are included in Section 3.6.1.3.

1.3 SYSTEM OVERVIEW

The mission, top-level functions, waste management concept and performance period of the system and system elements are defined in this section.

1.3.1 CRWMS Mission

The NWPAct assigned the DOE the mission to develop and operate an integrated waste management system for acceptance, transportation, storage (if approved), and disposal of SNF and high-level radioactive waste (HLW). The NWPAct also established the Office of Civilian Radioactive Waste Management (RW) to carry out that mission. RW, in turn, is developing the CRWMS as the operational and physical system capable of performing the integrated management system functions. RW's plan for successfully addressing this mandated mission is documented in the Office of Civilian Radioactive Waste Management Program Plan, Revision 2. The mission of the CRWMS is to provide for the timely disposal of the nation's SNF and HLW in a geologic repository in a manner that protects the health and safety of the public and of workers, and maintains the quality of the environment.

At present, a Centralized Interim Storage Facility (CISF) is not included in the cost and schedule baselines. However, the CRD includes, on a contingency basis, requirements with regard to

performance of a CISF. Requirements for and discussion of the CISF in Sections 3.5 and 3.6 are applicable only if a CISF is approved. However the requirements may be used for generic non-site specific contingency planning.

1.3.2 CRWMS Top-Level Functions

The top-level function of the CRWMS is to "Dispose of Waste," which includes directing or controlling any physical activity, operation, or process conducted to accept title and possession, transport, store (if approved), and emplace and isolate SNF and HLW. For planning, systems analysis, and conceptual design purposes, Dispose of Waste is broken down into three subfunctions that the CRWMS must perform: Accept and Transport Waste, Store Waste (if approved), and Emplace and Isolate Waste. The CRWMS functions are shown below in Figure 1-1. The top-level function flow for Dispose of Waste and its subfunctions is shown in Figure 1-2. A more detailed definition of the functions is provided in Appendix A.

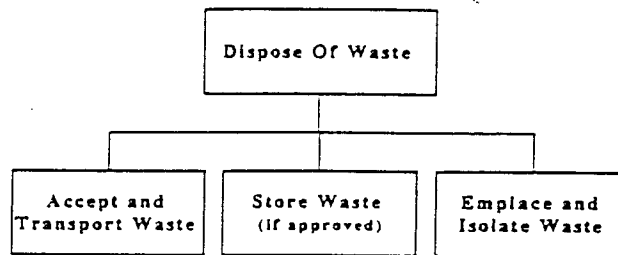


Figure 1-1 CRWMS Function Hierarchy

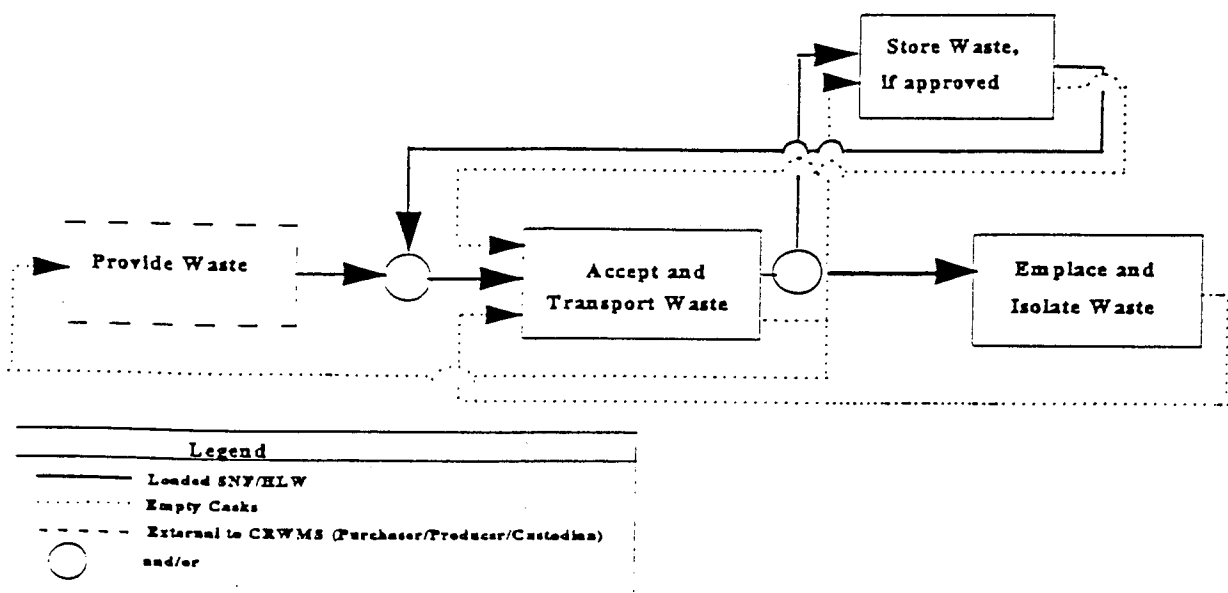


Figure 1-2 CRWMS Function Flow Diagram with Store Waste shown as If approved

1.3.3 Waste Management System Concept

The Dispose of Waste function is accomplished by three system elements. They are:

Waste Acceptance and Transportation (Configuration Item: D00000000)

CISF (if approved) (Configuration Item: C00000000)

Monitored Geologic Repository (MGR) (Configuration Item: B00000000)

The CISF is not currently approved except for contingency planning. The allocation of functions to these elements is as follows:

Accept and Transport Waste - Waste Acceptance and Transportation Element

Store Waste - CISF Element

Emplace and Isolate Waste - MGR Element

These system elements work in conjunction with each other to fulfill a variety of functional and performance requirements intended to make the transportation, storage (if approved), and permanent emplacement and isolation of waste in a geologic medium safe, environmentally acceptable, and cost effective. The CRWMS will provide appropriately documented conformance verification, accountability, and traceability of the waste from initial acceptance to final closure of the MGR. The system architecture is portrayed in Figure 1-3. A top-level description of the CRWMS and its concept of operations is provided in the *CRWMS Total System Description* (DOE/RW-0500).

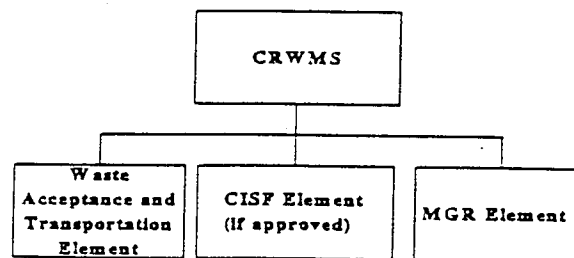


Figure 1-3 CRWMS Architecture

1.3.4 CRWMS Performance Period

CRWMS system performance begins with the start of site characterization; involves the acceptance, transportation, interim storage, and emplacement of SNF and HLW; and continues through the isolation of the waste from the accessible environment in a geologic repository, which may be at least 10,000 years following permanent closure of the MGR facility. The construction of facilities for the MGR operational period is preceded by site characterization activities essential to the design process, a viability assessment, an environmental impact statement, a site recommendation, and the licensing process. The site characterization activities require the construction of test facilities, which may, in part, be incorporated into the disposal system. Thus, requirements and planning documents must integrate the design for both the characterization period and the extended period of system performance.

1.3.5 Descriptions of SNF and HLW

SNF means fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated for reprocessing. SNF to be accepted for disposal consists of commercial SNF and DOE SNF. Commercial SNF is defined as SNF resulting from operation of a commercial nuclear power reactor and may include mixed oxide fuel. DOE SNF is defined as SNF that is currently managed by DOE. DOE SNF includes, but is not limited to, production reactor fuel, research reactor fuel, Naval fuel, and some fuel from commercial power reactors. For the purposes of this document, Naval SNF is called out separately, in some instances, because it is the subject of the Memorandum of Agreement (MOA) for the Acceptance of Naval Spent Nuclear Fuel and there are substantial differences between the Naval SNF and the remaining DOE SNF.

HLW consists of highly radioactive material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations; and other highly radioactive material that the Nuclear Regulatory Commission, consistent with existing law, determines by rule requires permanent isolation. The CRWMS will only accept solidified HLW. For the purposes of this document, HLW includes defense borosilicate glass, commercial borosilicate glass, and immobilized plutonium waste form (IPWF).

Government managed nuclear materials consist of both SNF and HLW that are in the custody of and will be accepted from a government agency.

2. REQUIREMENTS IMPLEMENTATION

2.1 PRECEDENCE

The order of precedence to be applied for external sources of requirements is as follows: Federal law (i.e., statutes and treaties; regulations and executive orders); state and tribal laws; local ordinances; and national and international standards.

2.2 QUALITY ASSURANCE DOCUMENTATION

The requirements defined in Section 3 will be met by the engineering development of a variety of structures, systems, and components (SSCs). The appropriate classification of SSCs and the engineering documentation produced to meet the requirements are prepared in accordance with the *Quality Assurance Requirements and Description* (QARD) (DOE/RW-0333P) requirements.

2.3 CONFORMANCE VERIFICATION

Documentation will be produced for each system element that further defines and implements the requirements defined in Section 3 and will provide an explanation of how the requirements allocated to that element have been satisfied. The methods selected for conformance verification should be consistent with the OCRWM Strategic System Management Policy.

2.4 PLANNING CONSIDERATIONS

Various planning considerations have been imbedded in the development of the requirements of Section 3. These include:

- A. Transportation equipment design and shipping responsibilities for Government-managed nuclear materials are documented in the Office of Environmental Management (EM)/RW Memorandum of Agreement (MOA) for Acceptance of DOE spent nuclear fuel (SNF), and high-level waste (HLW), and the Naval Nuclear Propulsion Program (NNPP)/RW MOA for Acceptance of Naval SNF.
- B. CRWMS facilities will be designed to minimize the generation of hazardous, low level, and mixed waste.
- C. For the purpose of Site Recommendation and License Application and for planning purposes and subsequent verification, the CRWMS shall be designed to accommodate the following inventory of nuclear materials: commercial SNF, as documented in the Integrated Data Base Report, (IDB), DOE/RW-0006, (Table 1.3, 86,700 MTHM); DOE SNF, as documented in the EM Integrated Spent Nuclear Fuel Database System (ISNFDS) (2502 MTHM, including Naval SNF, as documented in the Record of Decision for a Dry Storage Container System for the Management of Naval Spent Nuclear Fuel (65 MTHM)); defense and commercial

HLW, as documented in the IDB (Table 2.7, 19,333 DHLW canisters, 302¹ CHLW canisters); IPWF as documented in the Record of Decision of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement (17 metric tons, with at least 8 metric tons and possibly up to 50 metric tons). These sources define current inventory projections for SNF and HLW, but are not intended to preclude analyses of additional wastes.

- D. The assumption used in developing this requirements document regarding the extent of any blending of SNF (or HLW) that may be required is limited to that blending that can be accomplished through management of the waste stream.
- E. To support the CRWM Program Plan, the CRWMS must be designed to accomplish its performance functions with, or without, a CISF. To maintain the ability for expeditious implementation, the CISF remains an element of the CRWMS architecture.
- F. This requirements document addresses the requirements for retrieving waste from the repository, as mandated by the NWPA (42USC10142) and 10 CFR Part 60.111(b). During normal retrieval period, it is assumed that the reversed procedures for waste emplacement will be used to retrieve any waste material. If special capabilities are required, there will be time to design and construct them when retrieval is authorized.
- G. Transportation requirements and architecture will not be maintained for post-retrieval waste transport capability. This is because it is reasonable to believe that the MGR could serve as a post-retrieval storage site, and if not, that a "new" transport capability could be developed in the expected time frame during which substantive waste retrieval was being conducted.
- H. For transportation of commercial SNF, DOE SNF and HLW, private industry will be used to the fullest extent practicable. Federal services for such transportation will be used only when private industry is unable or unwilling to provide such services at reasonable cost, as determined by the Secretary, Department of Transportation (DOT), in consultation with DOE. The NNPP will transport Naval SNF to the CRWMS facilities as defined in the NNPP/RW MOA.
- I. CRWMS design and operations planning will be compatible with transportation of SNF and HLW to the repository by rail, heavy haul vehicle, and legal weight truck.
- J. The CRWMS is being designed and implemented to meet all applicable Nuclear Regulatory Commission (NRC) regulations for the protection of SNF and HLW.
- K. According to the terms of the agreement between the United States Department of State and the International Atomic Energy Agency (IAEA), any facility that is licensed by the NRC and is not determined to be important to national security is eligible to be selected by the IAEA

¹ The projected CHLW canisters range is from 250 to 302.

for inspection. Since CRWMS facilities will be licensed by the NRC, the IAEA will be able to select the CRWMS facilities for inspection. If any CRWMS facility is selected by IAEA for inspection, any resulting requirements would be codified in 10 CFR Part 75. This would obligate CRWMS facilities to comply with any IAEA requirements incorporated by the NRC for the safeguarding of special nuclear material contained within SNF and HLW.

- L. Any RW receipt facility(ies) will be capable of receiving the mix of pressurized water reactor (PWR) and boiling water reactor (BWR) SNF approved under 10 CFR Part 961. Additionally, the truck/rail split will satisfy the Annual Capacity Report (ACR)/Acceptance Priority Ranking (APR) allocation.
- M. The Government-managed nuclear materials delivery schedules will be coordinated with the commercial SNF delivery schedule to facilitate mixed emplacement underground.
- N. The MGR design will maintain flexibility by considering pending changes to applicable NRC repository licensing regulations and the Environmental Protection Agency (EPA) radiation protection standards.
- O. For planning purposes RW will emplace no more than 7,000 MTHM of Government-managed nuclear materials in the first repository unless a decision on the need for a second repository is made. These include vitrified high-level waste glass from the West Valley Demonstration Project (WVDP) commercial facility (CHLW), vitrified high-level waste glass from defense facilities (DHLW), DOE EM-owned SNF, Naval SNF, and immobilized plutonium waste form (IPWF) canisters (TBD 7). The planning base allocation for disposal of Government-managed nuclear material within the first repository will be one-third SNF and two-thirds HLW. The 2333 MTHM of SNF will be accepted from NNPP (65 MTHM) and from Fort St Vrain, Hanford, Idaho National Engineering and Environmental Laboratory (INEEL) and Savannah River Site (SRS). The nominal 4667 MTHM of vitrified HLW will be accepted from the New York State Energy Research and Development Authority (NYSERDA) (pending execution of an acceptance and disposal contract) and SRS) and may include IPWF canisters. Unused capacity within the current 2/3 HLW allocation will be filled with vitrified HLW from Hanford and INEEL. Waste from these sites will also be considered for any additional allocation that becomes available.
- P. Acceptance of WVDP CHLW, presently owned by NYSERDA, is contingent upon the establishment of an acceptance and disposal contract, or transition of ownership of the CHLW to EM.
- Q. Acceptance of IPWF is contingent upon the establishment of appropriate agreements between EM and MD addressing compliance with applicable CRWMS acceptance criteria.
- R. For planning purposes, RW assumes that EM will have custody of the IPWF with appropriate documentation at the time of pick-up at a designated producer site.

- S. According to the DOE/Navy/State of Idaho Settlement Agreement (Oct 17, 1995), all DOE SNF at INEEL is to be removed from Idaho by 2035. Naval fuel will be among the early shipments to a CRWMS receiving facility. The specific schedule for acceptance and disposal of DOE SNF to satisfy this agreement has not been determined. The schedule will be in accordance with the EM/RW and NNPP/RW MOAs.

2.5 LEVEL 0 SCOPE BASELINE

The Level 0 Work Scope Baseline for the CRWMS Strategic System is as follows:

- A. Surface- and subsurface-based data collection activities (e.g., site characterization) required to characterize the Yucca Mountain candidate site and determine its suitability as a repository for spent nuclear fuel and high-level radioactive waste. Products include a Viability Assessment, an Environmental Impact Statement (EIS), a Total System Performance Assessment, a Site Recommendation Report for submittal to the President if the site is suitable, a Repository License Application Design and a License Application for submittal to the NRC if the site is suitable.
- B. Activities required to plan for the acquisition of transportation and waste acceptance systems, and quality assurance activities, program management, regulatory coordination, program planning and administrative activities, all are in support of Yucca Mountain site characterization.

3. REQUIREMENTS

3.1 REGULATORY REQUIREMENTS

3.1.1 Primary Regulatory Requirements

This section identifies the primary requirements of the CRWMS as established by the federal laws and regulations that define them.

- A. All CRWMS elements shall comply with the applicable provisions of 42USC10101et seq "The Nuclear Waste Policy Act of 1982" as amended.
- B. All CRWMS elements shall comply with the applicable provisions of 10 CFR Part 20, "Standards for Protection Against Radiation".
- C. The CRWMS MGR element shall comply with the applicable provisions of 10 CFR Part 60, "Disposal of High-Level Radioactive Waste in Geologic Repositories".
- D. The CRWMS Waste Acceptance and Transportation element shall comply with the applicable provisions of 10 CFR Part 71, "Packaging and Transportation of Radioactive Material".
- E. The Waste Acceptance and Transportation element shall comply with the applicable provisions of DOT regulations as documented in Title 49 of the Code of Federal Regulations.
- F. The CRWMS CISF element shall comply with the applicable provisions of 10 CFR Part 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High Level Radioactive Waste".
- G. All CRWMS elements shall comply with the applicable provisions of 10 CFR Part 73, "Physical Protection of Plants and Materials".
- H. The CRWMS Waste Acceptance and Transportation element shall accept nuclear waste in accordance with 10 CFR Part 961, "Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste".
- I. All CRWMS elements shall comply with the applicable provisions of 29 CFR Part 1910, "Occupational Safety and Health Standards".

3.2 OVERALL SYSTEM - LEVEL REQUIREMENTS

3.2.1 Overall System Performance

- A. The CRWMS shall be designed to dispose of commercial SNF, DOE SNF, vitrified DHLW, vitrified CHLW and IPWF, in accordance with the NWPA and implementing regulations.

- B. The CRWMS shall be capable of accepting, transporting, and emplacing and isolating SNF and HLW at the annual rates specified in Table 3-1.

Table 3-1. CRWMS Receipt Rates ^{2 3}(In MTHM or Equivalent/Year (nominal))

Year	Commercial SNF	Government-managed Nuclear Materials
	Received annually at Repository	Received annually at Repository
2010	400	Naval SNF - 1 DPC IPWF - 60 canisters TBD 1
2011	600	Naval SNF -1 DPC IPWF - 60 canisters TBD 1
2012	1,200	Naval SNF -3 DPC IPWF - 60 canisters TBD 1
2013	2,000	Naval SNF -6 DPC IPWF - 60 canisters TBD 1
2014	3,000	Naval SNF -8 DPC IPWF - 60 canisters TBD 1
2015-2031	3,000 ⁴	TBD 1
2032	3,000	TBD 1
2033	1,900	TBD 1
2034-2041	TBD 9	TBD 1

² The actual operational load is a function of the numbers, types and sizes of casks and canisters in which the SNF and HLW are accepted from the points of origin. Since these specific numbers will not be determined until Purchaser/Producer/Custodian agreements are reached and schedules are established, the required rates are estimated in terms of desired systems-level MTHM acceptance rates.

³ The receipt rates of Government-managed nuclear materials will be provided by EM and NNPP, in accordance with memoranda of agreement, 5 years prior to acceptance. For planning purposes in order to satisfy National non-proliferation policies for surplus weapons plutonium disposition and to provide for acceptance of Naval SNF among the earliest shipments to the repository, minimum receipt rates are established as RW priority for acceptance between 2010 through 2014.

⁴ The current plan is that MOX SNF, from disposition of surplus weapons-usable plutonium will be part of the commercial SNF inventory.

- C. The CRWMS shall accept the MTHM or equivalent of SNF/HLW for disposal in the first repository that is authorized by the governing regulations. The currently planned amounts of waste, prior to a second repository being in operation, are shown in Table 3-2. This repository capacity is an operational limit only, in accordance with NWPA, Section 114(d), and is expected to be re-evaluated after the decision on the need for a second repository.

Table 3-2. Amount of SNF/HLW To Be Accepted in First Repository (In MTHM or Equivalent)

Type	Amount
Commercial SNF ⁵	63,000
Commercial HLW	640
Defense HLW ⁶	4,027
DOE SNF	2,333
Total	70,000

- D. The CRWMS shall only dispose of SNF or HLW that is not subject to regulation as hazardous waste under the Resource Conservation and Recovery Act (RCRA) Subtitle C in the first geologic repository licensed by NRC under the NWPA. Prior to acceptance for disposal, Producers and Custodians must determine and document that RCRA-regulated wastes are not present, and develop appropriate data to assure relevant state and/or EPA requirements are addressed. RW shall collect and review the available data and documentation for commercial SNF.
- E. CRWMS elements and facilities shall be capable of accommodating a range of storage and transportation technologies, including multi-purpose, dual-purpose, and single purpose canisters, as well as bare SNF assemblies.
- F. CRWMS facilities shall be capable of opening sealed storage/transportable commercial canisters, handling the SNF and managing associated site generated waste streams.
- G. CRWMS facilities shall establish and maintain material balance, inventory and records for stored materials in accordance with 10 CFR Part 72.72.

3.2.2 Site Generated Wastes

- A. CRWMS facilities shall maintain the separation of hazardous, non-hazardous, and radioactive wastes. These wastes will be managed and stored in accordance with required regulations.

⁵ This includes MOX SNF derived from 33 MTHM of surplus plutonium.

⁶ This includes approximately 17 MT of immobilized surplus plutonium.

- B. CRWMS site-generated hazardous and mixed waste shall be transported to government-approved off-site facilities for disposal.
- C. Radioactive and mixed wastes shall be managed in a manner that assures protection of health and safety.

3.2.3 Industry Codes and Standards

All CRWMS element SSCs shall be designed and fabricated in accordance with appropriate industry codes, standards, engineering principles and practices with particular attention to those which incorporate system safety, human factors, reliability, availability, maintainability, habitability standards, and environmental protection.

3.3 WASTE ACCEPTANCE AND TRANSPORTATION ELEMENT REQUIREMENTS

This section contains the requirements allocated to the Waste Acceptance and Transportation Element.

- A. The Waste Acceptance and Transportation Element shall be capable of transporting commercial SNF from the Purchaser sites to the MGR or CISF (if approved) and from the CISF (if approved) to the MGR.
- B. The Waste Acceptance and Transportation Element shall be capable of transporting standard, failed, and nonstandard commercial SNF described in 10 CFR Part 961.
- C. The Waste Acceptance and Transportation Element shall be capable of accepting and transporting HLW and DOE EM SNF as required in the EM/RW MOA and Naval SNF as required in the NNPP/RW MOA from the Producer/Custodian sites to the MGR or CISF (if approved) and from the CISF (if approved) to the MGR.
- D. The Waste Acceptance and Transportation Element shall be capable of transporting NRC-certified transportation casks, including the following general types:
 - Single-Purpose Casks
 - Canister Casks (Multi Purpose Canister (MPC) and Dual Purpose Canister (DPC))
 - Transportable Storage Casks (TSCs)
 - HLW Casks
 - Specialty Casks

These cask types are defined in Appendix B.

- E. CRWMS Waste Acceptance and Transportation Element shall collect necessary information in support of CRWMS activities. The type of data required includes, but is not limited to, the following:
 - 1. Contracts and Fees Information - Purchaser Contracts; Custodian and Producer Agreements and changes thereto; records of fee payments.

2. Planning and Scheduling Information - Delivery Commitment Schedules (DCS), DCS Exchanges, Final Delivery Schedules (FDS), integrated Acceptance Schedule developed in accordance with the EM/RW and NNPP/RW MOAs, Purchaser and Custodian SNF data, campaign schedules, acceptance, transportation, delivery, storage and emplacement schedules.
 3. Operations Support Information - Characterization data for Purchaser and Custodian SNF and Producer waste sufficient to satisfy 10 CFR Part 60.21(c)(5), loading safeguards verification data.
 4. Safeguards and Security Information - Nuclear Material Transaction reports (DOE/NRC Form 741), Nuclear Material Balance reports (DOE/NRC Form 742), and other information specifically agreed to (e.g. verification forms).
- F. CRWMS Waste Acceptance and Transportation Element shall process the above information in such a manner, including automated and manual data processing, to ensure availability to meet schedules.
- G. Information system security shall be provided to a level commensurate with the classification of the material being processed including physical security for data processing and record storage facilities, and restrictions on access to information.
- H. CRWMS Waste Acceptance and Transportation Element shall perform records management, including classification, receipt, storage, information retrieval and dispositioning of records identified in E above.
- I. Waste Acceptance and Transportation Element shall accomplish planning and scheduling according to the provisions of the Standard Contract (10 CFR Part 961) and the EM/RW and NNPP/RW MOAs.
- J. Integrated plans for CRWMS activities shall be developed and updated as needed to respond to changed data and operating conditions. Planning involves allocating system capacity, evaluating schedule requests, and establishing the CRWMS operations schedule.
- K. Records validation shall be initiated upon receipt of Purchaser/Producer/Custodian forms describing the SNF/HLW to be delivered.
- L. Waste Acceptance and Transportation shall validate title and/or transfer of responsibility and custody documentation from the Purchasers/Producers/Custodians.

3.4 MGR ELEMENT REQUIREMENTS

This section contains the requirements allocated to the MGR Element.

- A. The MGR shall be designed to be capable of accommodating the total inventory of SNF and HLW (as documented in Planning Consideration 2.4.C) consistent with current disposal

concepts (e.g., HLW/DOE SNF co-disposal). However, until the second repository is approved the MGR operational capacity shall be limited to 70,000 MTHM or equivalent of SNF and HLW.

- B. The waste packages shall be designed such that substantially complete containment of the waste can be demonstrated for at least 1,000 years.
- C. The monitored geologic repository concept shall allow the repository to be closed as early as 10 years after emplacement of the last waste package or to be kept open for at least 100 years from initiation of waste emplacement. The design shall not preclude the ability to keep the repository open, with appropriate maintenance and monitoring, for 300 years after initiation of waste emplacement. Future generations will make the ultimate decision on whether it is appropriate to continue to maintain the repository in an open, monitored condition or to close the repository, based on development of their own criteria and level of certainty regarding ultimate repository performance.

3.5 CISF ELEMENT REQUIREMENTS

If a CISF is approved, the following allocated requirements shall be met.

- A. The CISF shall be designed to expedite operations by using a phased approach with Phase I having the capability to receive and store licensed dual purpose and multi-purpose systems only and Phase 2 having the capability to receive and store SNF in licensed dual purpose and multi-purpose systems and as individual assemblies at the rates indicated in Table 3-3.

Table 3-3. CISF Receipt Rates⁷ (In MTHM or Equivalent/Year)

Phase	Year of Operation	Commercial SNF ⁸	Government Managed Nuclear Materials
I	1	1200	TBD 3
I	2	1200	TBD 3
II	3 and 4	2000	TBD 4
II	5	2700	TBD 4
II	6 and subsequent	3000	TBD 4
II	TBD 2	3000	TBD 4

⁷ Receipt rates in this table are only applicable if a CISF is approved.

⁸ This could include MOX SNF in Phase II.

- B. The CISF shall have a minimum storage capacity of 10,000 MTHM of SNF.
- C. The CISF shall have a HLW storage capacity of (TBD 6).
- D. The CISF shall be capable of preparing SNF and HLW for off-site transport.

3.6 INTERFACE REQUIREMENTS

This section identifies the interface requirements between CRWMS system elements. Acceptance criteria for nuclear materials are documented in the Waste Acceptance System Requirements Document (WA-SRD) (DOE/RW-0351P).

3.6.1 Waste Acceptance and Transportation - Government Agency Interface Requirements

Waste Acceptance and Transportation shall interface with appropriate federal, state, tribal, and local government agencies to meet legal, regulatory and operational requirements for acceptance and transportation of SNF and HLW, such as route selection, approval, scheduling and notification, emergency planning and response, and security.

3.6.2 MGR External Interface Requirements

MGR shall interface with appropriate federal, state, tribal, and local government agencies to meet legal, regulatory and operational requirements for emplacement and isolation of waste, such as scheduling, permitting, notifications, emergency planning and response, and security.

3.6.3 CISF External Interface Requirements (if CISF approved)

CISF shall interface with appropriate federal, state, tribal, and local government agencies to meet legal, regulatory and operational requirements for storage of waste, such as scheduling, notifications, emergency planning and response, and security.

3.6.4 CRWMS Interface Requirements with EM and MD

EM shall provide requirements to MD to ensure that IPWF can comply CRWMS acceptance criteria.

3.6.5 System-Level Interface Requirements

This section describes interface requirements between CRWMS Elements.

Assumptions developed during design of Element SSCs shall be reviewed and agreed upon by other elements if they impact inter-element interfaces.

3.6.5.1 Waste Acceptance and Transportation - MGR Interface Requirements

This section identifies the interface requirements between Waste Acceptance and Transportation and

MGR regarding the receipt, unloading, and return of transportation casks.

- A. Transportation equipment and the MGR site roads, railways, queuing points, and the site layout shall be physically and functionally compatible to accommodate movement of transporters, consistent with the expected cask receipt and return rates necessary to meet requirements in Section 3.2.1.B.
- B. Transportation equipment and the MGR equipment shall be physically and functionally compatible to accommodate required handling functions consistent with the expected cask receipt and return rates.
- C. Waste Acceptance and Transportation and MGR shall coordinate to provide for radiological surveys, decontamination, and security inspections of transportation equipment upon arrival at the MGR.
- D. Waste Acceptance and Transportation and MGR shall coordinate to provide for radiological surveys, decontamination, inspection, and testing of transportation equipment prior to departure from the MGR.
- E. Waste Acceptance and Transportation shall exchange technical, planning and operational information with the MGR to facilitate receipt, handling, and return of transportation equipment.
- F. Waste Acceptance and Transportation and MGR communications equipment shall be compatible and provide for necessary communication between the elements.
- G. Waste Acceptance and Transportation and MGR information systems shall provide for necessary data exchange between the elements.
- H. MGR shall have the capability to perform incidental transportation cask maintenance necessary to support cask receipt and return rates.
- I. Waste Acceptance and Transportation and MGR shall exchange technical, planning and operational information to ensure waste is accepted into the system and delivered to the MGR in accordance with emplacement and isolation capabilities.

3.6.5.2 Waste Acceptance and Transportation - CISF Interface Requirements (if approved)

This section identifies the interface requirements between Waste Acceptance and Transportation and CISF.

- A. Transportation equipment and the CISF site roads, railways, queuing points, and the site layout shall be physically and functionally compatible to accommodate movement of transporters, consistent with the expected cask receipt and return rates necessary to meet requirements in Section 3.2.1.B.

- B. Transportation equipment and the CISF equipment shall be physically and functionally compatible to accommodate required handling functions consistent with the expected cask receipt and return rates.
- C. Waste Acceptance and Transportation and CISF shall coordinate to provide for radiological surveys, decontamination, and security inspections of transportation equipment upon arrival at the CISF.
- D. Waste Acceptance and Transportation and CISF shall coordinate to provide for radiological surveys, decontamination, inspection, and testing of transportation equipment prior to departure from the CISF.
- E. Waste Acceptance and Transportation shall exchange technical, planning and operational information with the CISF to facilitate receipt, handling, and return of transportation equipment.
- F. Waste Acceptance and Transportation and CISF communications equipment shall be compatible and provide for necessary communication between the elements.
- G. Waste Acceptance and Transportation and CISF information systems shall provide for necessary data exchange between the elements.
- H. CISF shall have the capability to perform incidental cask maintenance necessary to support cask receipt and return rates.
- I. Waste Acceptance and Transportation and CISF shall exchange technical, planning and operational information to ensure waste is accepted into the system and delivered to the CISF in accordance with interim storage capabilities.

3.6.5.3 MGR - CISF Interface Requirements (if CISF approved)

This section identifies the interface requirements between MGR and CISF.

- A. MGR and CISF communications equipment shall be compatible and provide for necessary communication between the elements.
- B. MGR and CISF information systems shall provide for necessary data exchange between the elements.

APPENDIX A. FUNCTION DEFINITION

This Appendix provides definition of the functions which are depicted in Figure 1-1. These definitions are not requirements but represent the essential functions which must be performed in order for the CRWMS to accomplish its mission.

A.1 Dispose of Waste Function

Manage and dispose of the nation's SNF and HLW by conducting any physical activity, operation, or process required to accept, transport, store in a CISF (if approved), and emplace and isolate SNF and HLW in a geologic repository in a timely manner, and in a manner that protects the health and safety of the public and of workers and the quality of the environment.

A.1.1 Accept and Transport Waste Function

This function includes the acceptance by RW of loaded casks for transport, the movement of loaded and unloaded casks between Purchaser/Producer/Custodian sites and retrieval from DOE CRWMS facilities, and the movement of loaded and unloaded casks between DOE CRWMS facilities. NNPP shall deliver NNPP SNF to the RW facility.

Based on final delivery schedules and waste form descriptions, develop and distribute campaign plans to affected parties that identify shipping schedules, equipment requirements, technical support requirements, operations contingencies, transport mode requirements, and advance preparations requirements. Whenever external factors or variances change the existing campaign plans, reinitiate planning. Reissue revised plans and coordinate with those affected. Provide technical assistance and funding for training public safety officials of local governments and Indian Tribes through whose jurisdiction SNF and HLW will be shipped. Provide for the receipt, organization, storage, and dissemination of CRWMS operational, MC&A and other waste information.

Provide operational, logistical, and administrative support for operating and maintaining the transportation system. Receive, transport and deliver transportation cask subsystems and ancillary equipment to support acceptance and transportation of SNF and HLW. Receive transportation cask subsystems (including canisters) from cask fabricators for transport in accordance with DOT and NRC regulations. Check the cask system readiness (evidence of CoC for new cask subsystems), prepare the cask subsystem for shipment, including inspection, certification of condition and documentation, and transfer of responsibility for shipment. EM and NNPP will design and procure their SNF canisters and casks.

Move the unloaded and new cask subsystems and ancillary equipment to Purchaser/Producer/Custodian sites. Prior to transfer of title and/or responsibility and custody, ensure acceptability of the waste form for transportation, storage and emplacement, and resolve any identified discrepancy between the description of the waste provided in documentation and the actual contents of the transportation cask with the Purchaser/Producer/Custodian. Provide technical support for cask and canister loading operations, including assistance as requested to Purchaser/Producer/Custodian in cask and canister handling and loading, use of site-specific equipment needed in the shipping campaign, training of personnel in cask loading and waste safeguards verification operations and in providing

technical advice and assistance to Purchasers/Producers during cask and canister handling, loading, and preparation for shipment. Transfer documents between the Purchaser/Producer/Custodian and RW at the time of acceptance. Provide loading, acceptance and shipping phase conformance and safeguards verification. Confirm completeness and compliance, accept title and/or responsibility and custody to waste, and release for transportation. Inspect the loaded cask documentation to ensure compliance with regulatory requirements. Brief the transporter crew and escorts, and confirm compliance with regulatory requirements. Certify that the shipment is in proper condition for transportation, and provide required documentation to the carrier crew. Receive carrier acknowledgment of transfer of responsibility for the shipment by carrier signing the bill of lading.

Provide physical containment of waste in a manner that meets the requirements of the NRC CoC. Transport the loaded cask subsystem from the Purchaser/Producer/Custodian site to a CRWMS site (or between CRWMS sites). Issue appropriate notices to appropriate Federal, State, and Tribal authorities, and shipping and receiving activities, in accordance with the operational procedures, campaign plans, and coordinated schedules. Monitor and provide direction for the operators of cask subsystem equipment while it is engaged in physically transporting SNF/HLW. Support transportation operations with training, technical assistance, in-transit maintenance, and assistance in recovering an in-transit cask system in the event of an incident/accident. Monitor progress reports of shipments and develop system status metrics. Maintain up-to-date system status information and projections.

Deliver the loaded cask to a CISF, the MGR, or other designated location. Conduct a physical inspection of the loaded cask and debrief the carrier crew upon arrival at the designated site. Deliver the shipping document package to the consignee, along with any supplemental documentation provided by the shipper and transfer responsibility for the loaded cask to the consignee. Provide for service if a vehicle or transporter requires repair, as identified during the debrief.

Provide utilities and services in support of waste acceptance and transportation operations. Provide general protective services and safeguarding of nuclear materials and security of non-nuclear assets to ensure the safety and security of personnel, materials, and operations during transportation operations under both normal and off-normal conditions. Define, collect, process, and disseminate information on acceptance and transportation operations. Provide for the central collection, storage and dissemination of CRWMS operational records. Manage the inventory of transportation equipment, including the casks, canisters, transporters, ancillary equipment, special tools and fixtures, spare parts and consumable supplies that are used in performance of transportation functions. Provide general administrative support for the transportation system, including, but not limited to, records maintenance, engineering, human resources, training, procurement, public relations, and financial accounting. Collect, store, sort, treat, package, and dispose of the wastes that are generated during transportation operations. Maintain transportation operating facilities. Operate equipment, buildings, and utilities. Provide facilities and equipment to support a QA program which is required for all transportation system quality affecting work.

Decontaminate equipment and prepare for its disposal. Decontaminate and demolish facilities and reclaim site.

A.1.2 Store Waste Function (if approved)

This function includes the storage of SNF/HLW in a manner that protects the health and safety of the public and maintains the quality of the environment, with the intent to collect or to gather the SNF/HLW for disposal.

Handle both truck and rail shipments of SNF/HLW which may arrive canistered or uncanistered in transportation casks. Transfer casks from incoming vehicles to site handling vehicles and decontaminate and inspect the external surfaces of the casks and associated vehicles. Provide on-site lag storage of shipping casks, both loaded and unloaded. Prepare the SNF/HLW for storage, transfer the SNF/HLW to its interim storage location, retrieve the SNF/HLW from interim storage, and prepare the SNF or HLW for transport for permanent disposal. Place uncanistered and canistered SNF in containers prior to storage. Provide for handling abnormal conditions, if encountered during these processes. Store the SNF/HLW in an environment designed to prevent its degradation. Monitor the status of the waste to ensure that its safe condition is maintained.

Provide operational, logistical, and administrative support for operating, maintaining, and decommissioning the CISO. Define, collect, process, and disseminate information on storage operations. Provide utilities and services, including, but not limited to, communication, water, power, illumination, emergency medical treatment, fire protection, radiological protection, environmental monitoring, and on-site transportation in support of CISO operations. Provide general protective services and safeguarding of nuclear materials and security of non-nuclear assets to ensure the safety and security of personnel, materials, and operations at the CISO under both normal and off-normal conditions. Provide general administrative support to storage, including, but not limited to, records maintenance, engineering, human resources, training, procurement, public relations, and financial accounting. Prepare and dispose of all forms of wastes that are generated at the CISO. Collect, store, sort, treat, package, and dispose of the wastes generated. Maintain CISO operating facilities. Provide facilities and equipment to support a QA program which is required for all CISO quality affecting work. Receive, interpret, and distribute external direction (permits, regulations, procedures, etc.) to all Store Waste functions for implementation. Support the operations and maintenance of the CISO.

A.1.3 Emplace and Isolate Waste Function

This function includes emplacing SNF and HLW in a geologic medium and isolating such wastes from the accessible environment.

Operate surface and subsurface facilities to handle SNF and HLW (including receiving, preparing, transferring, temporarily storing, emplacing, and retrieving [if required] radioactive wastes), and provide operational, logistical, and administrative support for operating and maintaining the MGR (including, but not limited to supplying utilities and services, security, QA, and administration). Define, collect, process, and disseminate information on emplacement and isolation operations. Continue and complete the development of underground openings necessary for the successful operation of the MGR. Confine the waste in a disposal container and limit release from the container. Prepare and dispose of hazardous and mixed waste off-site.

Inhibit transport of radionuclides to the accessible environment so that amounts and concentrations of these materials are kept within prescribed limits.

Estimate the ability of the repository system to comply with regulations governing its preclosure and postclosure performance objectives and its effects on the environment; update compliance documents and support continuing development of the system; and conduct performance confirmation and environmental monitoring programs to supply data for estimates. Assess need for postclosure monitoring.

Permanently close the subsurface MGR to human access. At closure, remove subsurface equipment; backfill subsurface openings and boreholes; and seal shafts, ramps and boreholes. Backfilling may include all or part of the underground facility (i.e., emplacement drifts) if deemed necessary by analysis and authorized by the license. Permanently remove surface facilities and components necessary only for preclosure operations from service after repository closure, in accordance with regulatory requirements and environment policies. Decontaminate, dismantle, and remove facilities and reclaim the site. Establish institutional controls for restricting access and avoiding disturbance to the MGR controlled area and minimize or prevent intentional and unintentional activities in and around the MGR that could breach the barrier systems. Restore the MGR site to an acceptable condition that requires minimal on-going maintenance. (This does not preclude partial backfilling before permanent closure.)

APPENDIX B. DEFINITIONS

B.1 GLOSSARY

This section provides definitions of key terms used in the CRD. These definitions are not requirements but are provided to ensure consistency when describing the CRWMS and its requirements.

Acceptance, as used in this document, is the process by which the CRWMS will take title and/or responsibility and custody and physical possession of SNF or HLW from the Purchaser/Producer/Custodian. Conceptually, acceptance is accomplished by execution of the Accept and Transport Waste functions. Specifically, acceptance is the planning, preparation, and completion of the documentation necessary to transfer title and/or responsibility and custody. Any actual handling of the SNF and HLW related to their transfer is accomplished by other CRWMS elements: primarily the Waste Acceptance and Transportation element and/or the Purchaser/Producer/Custodian.

Architecture is the physical system to be built, found, or selected to perform a function subject to its stated requirements.

As low as is reasonably achievable (ALARA) means making every reasonable effort to maintain exposures to radiation as far below the dose limits in 10 CFR Part 20 as is practical consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of nuclear energy and licensed materials in the public interest. (As defined in 10 CFR Part 20.1003.)

Blending is (1) selecting SNF assemblies of different characteristics for inclusion in an MPC, transportation cask, storage mode, or waste package, or (2) selecting HLW of different characteristics for inclusion in a transportation cask or waste package to meet design goals.

Borosilicate waste glass is glass typically containing approximately 20 to 40 wt.% waste oxides, 40 to 65 wt.% silica, 5 to 10 wt.% boron oxide, and 10 to 20 wt.% alkali oxides, plus other oxide constituents.

Campaign is the activities required to prepare for and execute a consecutive set of shipments from a given shipping (originating) site over a fixed period of time.

Can-in-Canister concept consists of ceramic Pu matrix material, in disks, inside of sealed stainless steel cylindrical cans (plutonium cans) which are arrayed within the typical defense HLW canister by magazines. Molten borosilicate-HLW glass is poured into the canister, allowed to cool and solidify. Then the HLW canister, with concentric neck and lifting flange, is appropriately sealed.

Canister is the structure surrounding the waste form (e.g., HLW immobilized in borosilicate glass) that facilitates handling, storage, transportation, and/or disposal. A canister is a metal receptacle with the following purpose: (1) for solidified HLW, its purpose is a pour mold and (2) for SNF, it may

provide structural support for intact SNF, loose rods, nonfuel components, or confinement of radionuclides.

Cask is a container for shipping or storing spent nuclear fuel and/or canistered high-level waste that meets all applicable regulatory requirements. The following types of casks are utilized by the CRWMS:

1. **Single-Purpose Casks** - These transportation casks are primarily intended for transporting uncanistered, standard and nonstandard SNF from Purchaser/Custodian sites to a CRWMS site.
2. **Canister Casks** - These transportation casks are for transporting canisters (MPC or DPC) containing SNF from Purchaser/Custodian sites to CRWMS sites and between CRWMS sites.
3. **Transportable Storage Casks (TSCs)** - These transportation casks are for storing uncanistered SNF at Purchaser sites, transporting SNF from Purchaser sites to CRWMS facilities, and storing SNF at the CISF.
4. **HLW Casks** - These transportation casks are for transporting commercial and defense HLW from Producer sites to the MGR.
5. **Specialty Casks** - These transportation casks are for transporting nonstandard SNF, and/or fuel related hardware, and/or failed fuel from Purchaser/Custodian sites to the MGR.

Centralized Interim Storage Facility (CISF) is a federally licensed facility for acceptance of spent nuclear fuel and high-level nuclear waste from owners and generators for temporary storage prior to permanent disposal in a repository. It will be designed, constructed, and operated for the receipt, transfer, handling, packaging, possession, safeguarding, and storage of SNF pending shipment to MGR for disposal. A CISF requires an Act of Congress.

Certificate of Compliance (CoC) is a certificate approving for use, with identified limitations, a specific packaging for quantities of radioactive materials exceeding A1/A2 quantities as defined in 10 CFR Part 71 and 49 CFR Part 173. As used in this document, CoC refers to a certificate issued by the NRC. (As defined in DOE Order 1540.3 Section 4.a.)

Civilian Radioactive Waste Management System (CRWMS) is the composite of sites, facilities, systems, equipment, materials, information, activities, and personnel required to perform those activities necessary to manage spent nuclear fuel and high-level radioactive waste disposal.

Commercial High Level Radioactive Waste (CHLW) is the high-level radioactive waste, as defined by NWPA 42USC10101(12), resulting from reprocessing spent nuclear fuel in a commercial facility.

Commercial Spent Nuclear Fuel is SNF resulting from operation of a commercial nuclear power reactor. Specifically in this document, SNF includes (1) intact, non-defective fuel assemblies; (2) failed fuel assemblies in canisters; (3) fuel assemblies in canisters; (4) consolidated fuel rods in canisters; (5) nonfuel components inserted in PWR fuel assemblies, including, but not limited to, control rod assemblies, burnable poison assemblies, thimble plug assemblies, neutron source

assemblies, and instrumentation assemblies; (6) fuel channels attached to BWR fuel assemblies; and (7) nonfuel components and structural parts of assemblies in canisters.

Conformance Verification is the process used to demonstrate that SNF and/or HLW are in accordance with CRWMS acceptance criteria.

Configuration Item is an aggregation of hardware, software, or any of its discrete components that satisfies individual physical, functional and/or interface characteristics and is controlled by configuration management as a distinct item. CIs may vary widely in complexity, size, and type. CIs are those items or activities whose performance parameters and physical characteristics are separately controlled and defined to achieve the overall end use function and performance during design and development, procurement, manufacturing, testing, and installation.

Container is the component of the waste package that is placed around the waste form or the canistered waste form.

Contract is the agreement set forth in 10 CFR Part 961.11 and any duly executed amendment or modification thereto.

Controlled area or controlled use area means an area, outside of a restricted area but inside the site boundary, access to which can be limited by the licensee for any reason. (As defined in 10 CFR Part 20.1003.)

MGR controlled area means a surface location, to be marked by suitable monuments, extending horizontally no more than 10 kilometers in any direction from the outer boundary of the underground facility, and the underlying subsurface, which area has been committed to use as a geologic repository and from which incompatible activities would be restricted following permanent closure.

Postclosure controlled area means a surface location, to be marked by suitable monuments, extending horizontally no more than 10 kilometers in any direction from the outer boundary of the underground facility, and the underlying subsurface, which area has been committed to use as a geologic repository and from which incompatible activities would be restricted following permanent closure.

Preclosure controlled area means that surface area surrounding the geologic repository operations area for which the licensee exercises authority over its use, in accordance with the provisions of this part, until permanent closure has been completed.

Custodian means any government agency which possesses spent nuclear fuel which is a candidate for disposal in the CRWMS.

Decommission means to remove safely from service and reduce residual radioactivity to a level that permits: for land or facilities, release of the property for unrestricted use and termination of license (for the repository, some restrictions on use of the area above the repository will apply); and for casks, release of the cask for appropriate disposal. (As defined in 10 CFR Part 72.3.)

Defense high-level radioactive waste (DHLW) is the high-level radioactive waste, as defined by NWSA 42USC10101(12), resulting from reprocessing spent nuclear fuel in a defense facility.

Disposal is the isolation of radioactive wastes from the accessible environment. (As defined in 10 CFR Part 60.2.) Disposal means the emplacement of high-level radioactive waste, spent nuclear fuel, or other highly radioactive material in a repository with no foreseeable intent of recovery, whether or not such emplacement permits the recovery of such waste. (As defined in 10 CFR Part 961.11 and NWSA 42USC10101(9))

Disposal system is any combination of engineered and natural barriers that isolate spent nuclear fuel or radioactive waste after disposal.

Dispose of means the sum of the functions performed by the CRWMS to accept, transport, store and emplace and isolate waste.

DOE EM SNF is DOE SNF that is currently managed by EM, and is fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated. The inventory of DOE EM SNF projected to the year 2035 is provided in Table 3-4 in this document.

DOE-owned spent nuclear fuel (DOE SNF) is SNF that is currently managed by DOE, and includes fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated. DOE SNF includes, but is not limited to, production reactor fuel, research reactor fuel, Naval fuel, and some fuel from commercial power reactors. The inventory of DOE SNF projected to the year 2035 is provided in Table 3-4 in this document.

DOE/NRC Form-741 is a Nuclear Material Transaction Report and is completed whenever SNF or HLW is transferred or received. [10 CFR Parts 75.31, .33, .35]

DOE/NRC Form-742 is a Material Balance Report and when completed documents the quantities of SNF and/or HLW contained at an installation as of the initial inventory reporting date. [10 CFR Parts 75.31, .32, .33, .35]

Dual Purpose Canister (DPC) - refers to a sealed, metallic container maintaining multiple SNF assemblies in a dry, inert environment and overpacked separately and uniquely for storage and transportation or storage and disposal.

Function is a primary statement of purpose; it defines what a system or subsystem must accomplish to meet the system mission.

Geologic repository is a system that is intended to be used for, or may be used for, the disposal of radioactive wastes in excavated geologic media. A geologic repository includes: (1) the geologic repository operations area, and (2) the portion of the geologic setting that provides isolation of the radioactive waste. (As defined in 10 CFR Part 60.2.)

Geologic repository operations area (GROA) is a high-level radioactive waste facility that is part of a geologic repository, including both surface and subsurface areas, where waste handling activities are conducted. (As defined in 10 CFR Part 60.2.)

Glass transition temperature is the temperature at which, upon heating, the glass transforms from a rigid solid to a viscous liquid. This temperature corresponds to glass viscosity of approximately 10^{13} poise, and is less than 500°C, for most, if not all, borosilicate glass.

Government-managed nuclear materials includes DOE SNF, including Naval SNF, and HLW (commercial, defense and IPWF).

High-level radioactive waste (HLW) means (1) the highly radioactive material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations; and (2) other highly radioactive material that the Nuclear Regulatory Commission, consistent with existing law, determines by rule requires permanent isolation. The CRWMS will only accept solidified HLW. For the purposes of this document, HLW is vitrified borosilicate glass cast in a stainless steel canister (this includes the immobilized plutonium defined in IPWF and Can-in-Canister). (As defined in NWP 42USC10101(12), 10 CFR Part 72.3, 10 CFR Part 960.2, 10 CFR Part 961.11. (Note that the 10 CFR Part 60 definition of HLW includes SNF. See definitions of commercial HLW and defense HLW.))

Immobilized Plutonium Waste Form (IPWF) is the canistered plutonium waste which will be received by the RW for repository emplacement. It consists of a HLW canister containing plutonium immobilized using the can-in-canister concept. (See Can-in-Canister)

(Items) Important to safety with reference to structures, systems, and components, means those engineered features of the repository whose function is: (1) To provide reasonable assurance that high-level waste can be received, handled, packaged, stored, emplaced, and retrieved without exceeding the requirements of 10 CFR Part 60.111(a) for Category 1 design basis events; or (2) To prevent or mitigate Category 2 design basis events that could result in doses equal to or greater than the values specified in 10 CFR Part 60.136 to any individual located on or beyond any point on the boundary of the preclosure controlled area.

(Items) Important to waste isolation means the natural and engineered barriers that are relied on for achieving the postclosure performance objectives in 10 CFR Part 60 Subpart E.

Institutional barrier system consists of the active and passive institutional controls.

Active institutional controls include: (1) Controlling access to MGR by any means other than passive institutional controls; (2) Controlling or cleaning up release from a site; (3) Monitoring parameters related to disposal system performance; or (4) Performing maintenance operations or remedial actions at a site.

Passive institutional controls include: (1) Permanent markers placed at a disposal site; (2) Public records and archives; (3) Government ownership and relationship and regulations regarding land

or resource use, and (4) other means of preserving knowledge about the location, design, and contents of a disposal system.

Interface requirement means a requirement that applies to the inputs to, or outputs from, the function; or the physical connection or dependence between architectural items.

Isolation is inhibiting the transport of radioactive material so that amounts and concentrations of this material entering the accessible environment will be kept within prescribed limits. (As defined in 10 CFR Part 60.2.)

Licensee is a person who is authorized to conduct activities under a license or construction permit issued by the Nuclear Regulatory Commission. (As defined in 10 CFR Part 2.4.)

Metric Tons Heavy Metal (MTHM), as used in this document, refers to the quantity of heavy metal as used in NWPA, or equivalent.

Multi Purpose Canister (MPC) - refers to a sealed, metallic container maintaining multiple SNF assemblies in a dry, inert environment and over packed separately and uniquely for the various system elements of storage, transportation, and disposal.

Naval SNF is DOE SNF that is currently managed by NNPP, and is fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated. The inventory of Naval SNF projected to the year 2035 is provided in Table 3-4 in this document.

Nonconforming waste - HLW and/or DOE SNF that does not meet the applicable requirements in Sections 3.6.1.3.6 and 3.6.1.3.7.

Nonstandard waste is nonconforming HLW and/or DOE SNF that has been reviewed and deemed acceptable into the CRWMS. Nonstandard waste may also be in a condition which requires special handling. This general definition is specifically applied to HLW and SNF in this requirements document.

Overpack is a structural component used to hold and protect the MPC or DPC so that the combination meets the NRC requirements for its application. There are several types of overpacks: one for transportation, 10 CFR Part 71; one for transfer, 10 CFR Part 72; one for storage, 10 CFR Part 72; and one for disposal, 10 CFR Part 60. An overpack is designed for its particular use in conjunction with the MPC or DPC.

Owner is any person who has title and/or responsibility and custody to spent nuclear fuel or high-level radioactive waste. (As defined in 10 CFR Part 961.3.)

Package is the packaging together with its radioactive contents as presented for transport. (As defined in 10 CFR Part 71.4.)

Packaging is the assembly of components necessary to ensure compliance with packaging requirements of 10 CFR Part 71. It may consist of one or more receptacles, absorbent materials,

spacing structures, thermal insulation, radiation shielding, and devices for cooling or absorbing mechanical shocks. The vehicle, tie-down system, and auxiliary equipment may be designated as part of the packaging. (As defined in 10 CFR Part 71.4.)

Performance Requirement means a defined capability the CRWMS or one of its elements must have to accomplish its allocated functions.

Person means: (1) Any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, Government agency other than the NRC or the DOE, and State or any political subdivision of or any political entity within a State, any foreign government or nation or any political subdivision of any such government or nation, or other entity; and (2) Any legal successor, representative, agent, or agency of the foregoing. (As defined in 10 CFR Part 20.1003.)

Physical system means the CRWMS consisting of the composite of the sites, and all facilities, systems, equipment, materials, information, activities, and the personnel required to perform those activities necessary to Dispose of Waste.

Producer is any generator of high-level radioactive waste resulting from atomic energy defense activities or any producer of vitrified commercial HLW who has executed an acceptance and disposal contract. For purposes of this document, WVDP, which has commercial HLW, will be considered a "Producer" only when an acceptance and disposal contract is executed.

Product Consistency Test is a test developed to determine the composition and homogeneity of complex and varied radioactive waste glasses. [Ref. ASTM C-1285-94]

Production Record is the documentation, provided by the Producer, that describes the actual canistered waste form.

Purchaser is any person, other than a Federal agency, who is licensed by the NRC to use a utilization or production facility under the authority of Sections 103 or 104 of the Atomic Energy Act of 1954 (42USC2133, 2134), or who has title to SNF or HLW and who has executed a contract or other contractual agreement with DOE. Purchaser SNF includes Government-owned SNF from commercial industry and civilian development programs for which fees have been paid under the Standard Contract, 10 CFR Part 961.

Repository is synonymous with geologic repository.

Requirement is a qualitative or quantitative statement of how well a function must be performed.

Safeguards Verification is the process used to demonstrate that for all special nuclear material (as defined in 10 CFR Part 70), appropriate safeguards are in place.

Shipment is the movement of the properly prepared (loaded, unloaded, or empty) cask from one site to another and all associated regulatory activities.

Site characterization means the program of exploration and research, both in the laboratory and in the field, undertaken to establish the geologic conditions and the ranges of those parameters of a particular site relevant to the procedures under 10 CFR Part 60. Site characterization includes borings, surface excavations, excavation of exploratory shafts, limited subsurface lateral excavations and borings, and in situ testing at depth needed to determine the suitability of the site for a geologic repository, but does not include preliminary borings and geophysical testing needed to decide whether site characterization should be undertaken. (As defined in 10 CFR Part 60.2.)

Special nuclear material means (1) plutonium, uranium 233, uranium enriched in the isotope 233 or in the isotope 235, and any other material that the NRC, pursuant to the provisions of Section 51 of the Atomic Energy Act of 1954 as amended, determines to be special nuclear material, but does not include source material; or (2) any material artificially enriched by any of the foregoing but does not include source material. (As defined in 10 CFR Part 70.4.)

Spent nuclear fuel (SNF) is fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated by reprocessing. (As defined in NWSA 42USC10101(23) and 10 CFR Part 961.11.)

Standard waste is HLW and/or DOE SNF that meets the physical characteristics specified in this requirements document as standard. Other standard HLW forms will be defined in subsequent revisions of the CRD. This general definition is specifically applied to HLW and SNF in this requirements document.

Storage and Shipping Records are the documents that describe the physical attributes of the canistered waste forms. The records also identify any unexpected events, such as thermal excursions, which have occurred during storage.

Structures, Systems, and Components, or SSC, is a general term that means the standard English definition of those individual words. In this document, if and when an SSC is used in a way that requires any qualification, such as important to safety or important to waste isolation, that qualifier will also be provided.

System element is one of the three major configuration items which are required to accomplish the functions of the CRWMS. The three system elements are Waste Acceptance and Transportation, CISF and MGR. This differs from the "project" that may be initiated by DOE to manage and control development of one or more system elements (e.g., Yucca Mountain Site Characterization Project or Waste Acceptance, Storage and Transportation (WAST) Project).

Technical Baseline is a configuration identification document, or set of such documents, that is formally designated and approved at a specific time. Within the CRWMS, technical baseline is composed of, and evolves through, the functional and technical requirements baseline that is presented in the CRD, the design requirements baseline, the final design baseline, and the as-built baseline.

Time-temperature-transformation diagrams identify the duration of exposure at any temperature that causes significant changes in either the phase structure, the phase compositions, or the PCT response of the borosilicate glass waste type.

To Be Determined (TBD) is used as a placeholder to identify information that is not yet defined.

To Be Published (TBP) is used to identify memoranda that are yet to be published.

To Be Verified (TBV) is used to identify information that is unqualified, preliminary, or that needs to be reevaluated.

Transportation cask is a container for shipping spent nuclear fuel and/or high-level radioactive waste that meets all applicable regulatory requirements.

Transportation cask segment, as a minimum, includes the complete cask, canister (when required), truck trailer or rail car (defined as the transporter), a tie down system, an intermodal transfer device (when required), special tools and ancillary equipment.

Transporter is a cargo-carrying vehicle used for transportation of cargo. It includes semi-trailers, rail cars, intermodal transportation skids and equipment such as a tie-down components, personnel barriers, etc., needed to make the loaded cargo-carrying vehicle transport-ready.

Unrestricted area for the MGR means any area, access to which is not controlled by the licensee for the purposes of protection of individuals from exposure to radiation and radioactive materials, and any area used for residential quarters.

Validation is the process whereby data submitted is checked for legibility, reproducibility, completeness, arithmetical correctness and consistency. It is meant to distinguish this process from verifying the data, which implies an auditing process. In the case of data validation, the data will be required to be submitted under an NRC-approved QA program, and thus verification will not be necessary. However, validation will be performed to ensure that the data is complete and to limit the possibility for typographical errors.

Waste is SNF and HLW.

Waste Acceptance is the system element or organization that manages the Accept Waste function which includes acceptance of SNF and HLW into the CRWMS from the Purchaser/Custodian/Producer of such waste.

Waste form is the radioactive waste materials and any encapsulating or stabilizing matrix, whether canistered or not. A loaded MPC is a canistered waste form as defined in 10 CFR Part 60.2.

Waste Form Compliance Plan (WCP) is a document prepared by a waste producer describing planned analyses, tests, and engineering development work to be undertaken and information to be included in individual waste form production records to demonstrate compliance of a proposed waste form with waste acceptance specifications. For immobilized plutonium cans, this document is called a Plutonium Immobilization Compliance Plan (PICP).

Waste Form Qualification Report (WQR) is documentation prepared by a waste producer which describes results of analyses, tests, and engineering development work actually performed to

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demonstrate waste form compliance with waste acceptance specifications. For immobilized plutonium cans, this document is called a Plutonium Immobilization Qualification Report (PIER).

Waste handling activities include receipt of waste, preparation of waste for storage or disposal, transfer of waste from one cask to another or to its place of emplacement, emplacement of waste, and retrieval of waste.

Waste package is the waste form and any containers, shielding, packing, and other absorbent materials immediately surrounding an individual waste container. (As defined in 10 CFR Part 60.2.)

B.2 ACRONYMS AND ABBREVIATIONS

This section provides a listing of acronyms and abbreviations used in the CRD, along with their definitions.

ACR	Annual Capacity Report
ALARA	As low as is reasonably achievable
ANSI	American National Standards Institute
APR	Acceptance Priority Ranking
ASTM	American Society for Testing and Materials
BWR	Boiling Water Reactor
CFR	Code of Federal Regulations
CHLW	Commercial High-Level Radioactive Waste
CI	Configuration Item
CISF	Centralized Interim Storage Facility
CoC	Certificate of Compliance
CRD	CRWMS Requirements Document
CRWMS	Civilian Radioactive Waste Management System
DCS	Delivery Commitment Schedule
DHLW	Defense High-Level Radioactive Waste
DOE	U.S. Department of Energy
DOE/NO	DOE/Office of Naval Reactors
DOT	U.S. Department of Transportation
DPC	Dual Purpose Canister
EIS	Environmental Impact Statement
EM	DOE/Office of Environmental Management
EPA	U.S. Environmental Protection Agency
FDS	Final Delivery Schedule
HLW	High Level Radioactive Waste
IAEA	International Atomic Energy Agency
INEEL	Idaho National Engineering and Environmental Laboratory
IPWF	Immobilized Plutonium Waste Form
ISNFDS	Integrated Spent Nuclear Fuel Database System
MC&A	Material Control & Accounting
MGR	Monitored Geologic Repository
MOA	Memorandum of Agreement
MOX	Mixed Oxide
MPC	Multi Purpose Canister
MT	Metric Ton (Tonne)
MTHM	Metric Tons Heavy Metal
NNPP	Naval Nuclear Propulsion Program
NRC	Nuclear Regulatory Commission
NUREG	Nuclear Regulatory Commission Technical report
NWPA	Nuclear Waste Policy Act of 1982
NWPAA	Nuclear Waste Policy Amendments Act of 1987
NYSERDA	New York State Energy Research and Development Authority

OCRWM	Office of Civilian Radioactive Waste Management
OWAST	Office of Waste Acceptance, Storage and Transportation
PL	Public Law
PWR	Pressurized Water Reactor
QA	Quality Assurance
QARD	Quality Assurance Requirements and Description
RCRA	Resource Conservation and Recovery Act
RW	Office of Civilian Radioactive Waste Management
SI	International System of Units
SNF	Spent Nuclear Fuel
SRS	Savannah River Site
SSC	Structure, System, and Component
STD	Standard
TBD	To Be Determined
TBP	To Be Published
TBV	To Be Verified
Trans	Transportation
TSC	Transportable Storage Cask
USC	United States Code
WCP	Waste Form Compliance Plan
WQR	Waste Form Qualification Report
WVDP	West Valley Demonstration Project
YMSCO	Yucca Mountain Site Characterization Office